Vol. 20 OCTOBER, 1955 No. 10

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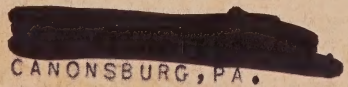

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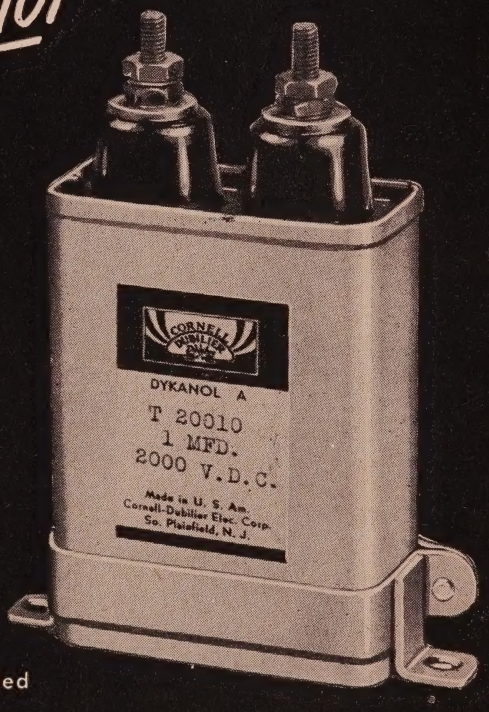

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TANK CIRCUITS

A transmitter tank circuit usually consists of a single coil and capacitor. The simplicity of this resonant circuit gives no clue as to the amount of careful design and painstaking optimizing which are required to insure its efficient operation.

The basic requirement is that the LC combination be resonant at the desired operating frequency. In a few applications, such as amateur transmitters, the circuit also must be tunable continuously over a band of frequencies. Equally important, however, is the requirement that the tank handle and transfer power efficiently.

In order to appreciate why the formulas for the tank circuit apply, it is necessary first to understand the physical operation of the coil, capacitor, and coil-capacitor combination. In the following discussion of these features, and throughout this article, frequency f will be expressed in megacycles, capacitance C in micromicrofarads, inductance L in microhenries, and reactance X_c and X_L in ohms.

CORRECTION

In the Coil Table on Page 7 of the August, 1955, issue of "The Capacitor," the coil L_2 covers a range from 5 Mc to 40 Mc; and coil L_3 from 35 Mc to 300 Mc.

The lower frequency limits of these two coils were incorrectly shown as kilocycles instead of megacycles.

Capacitor Operation

For any given value of capacitance (C), the reactance (X_c) of the capacitor varies inversely with frequency (f). At a given value of f, X_c varies inversely with C. Thus, $X_c = 10^6/(6.28fC)$. The negative sign is prefixed to the term for capacitive reactance, $-X_c$.

Example 1. The reactance of a 50-uufd capacitor at 3.5 Mc is $10^6/(6.28 \times 3.5 \times 50) = 1{,}000{,}000/1099 = 909.9$ ohms.

Example 2. At the same frequency 3.5 Mc, a 175-uufd capacitor has a reactance of $10^6/(6.28 \times 3.5 \times 175) = 1{,}000{,}000/3846.5 = 259.9$ ohms.

The **figure of merit** (Q) of the capacitor is the ratio of its reactance to resistance. Thus, $Q = X_c/R$. There is no simple way to measure radio-frequency resistance. In order to keep the capacitor Q high, R is minimized by careful design to reduce capacitor losses.

Coil Operation

For any given value of inductance (L), the reactance (X_L) of the coil varies directly with frequency (f). This is the opposite of capacitor action. At a given value of f, X_L varies directly with L. Thus, $X_L = 6.28fL$.

Example 3. The reactance of a 65-microhenry coil at 3.5 Mc is equal to $6.28(3.5)65 = 3.5(65) = 1428.7$ ohms.

Example 4. At the same frequency 3.5 Mc, a 174-uh coil has a reactance of $6.28(3.5)174 = 3824.5$ ohms.

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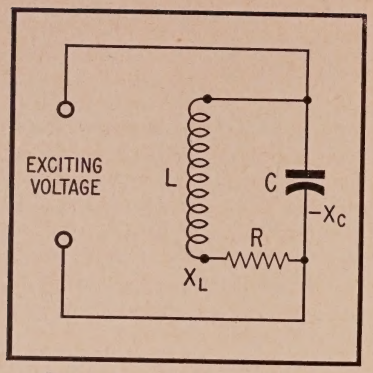

Fig. 1. Equivalent Tank Circuit.

The Q of the coil, like that of the capacitor, is the ratio of its reactance to resistance. Thus $Q = X_L/R$. In order to keep the coil Q high, R is minimized by designing for low losses.

Net Reactance

At resonance, the inductive reactance (X_L) and capacitive reactance ($-X_c$) are equal. The net reactance then is $X_L - X_c$. Since the two components are of opposite sign, they cancel, making the net circuit reactance zero. Only the resistance (R) remains to limit the tank current. See Figure 1. Most of this resistance is in the coil at frequencies below about 30 megacycles, all in-phase losses due to the insulating structures of the air-dielectric capacitor usually being too small for significance.

Example 5. At 7 Mc, a 25-microhenry coil has a reactance of 1100 ohms. At this same frequency, a 20.7-uufd capacitor has a reactance of —1100 ohms. In a tank circuit containing these two components, the net reactance is 1100 — 1100 = 0 ohms. The only impeding effect of the circuit then would be due to inherent resistance of the coil.

Resonant Frequency

At resonance, $X_L = X_c$, which is to say $6.28fL = 10^6/(6.28fC)$. To transfer the frequency term to the left side of the equation, both sides must be multiplied by 6.28f:

$$(6.28f)^2L = 10^6/C$$

To move the L term to the right side, both sides next are multiplied by $10^6/L$, and cancellation performed:

$$(6.28f)^2 = 10^6/LC$$

For f-terms only on the left side, both sides now are multiplied by $10^6/(6.28)^2$:

$$f^2 = 10^6/(6.28^2LC)$$

To obtain f, the square root of each side is taken:

(1)

$$f = \frac{10^6}{6.28\sqrt{LC}} \text{ kc} = \frac{10^3}{6.28\sqrt{LC}} \text{ Mc}$$

The latter is the familiar equation for the resonant frequency of an LC circuit. This expression may be found in many publications, and the foregoing derivation perhaps will clarify its meaning.

Example 6. The resonant frequency of a tank circuit composed of a 1000-uufd capacitor and 1-millihenry (1000 uh) coil is:

$f = 1000 / (6.28\sqrt{1000 \times 1000}) = 1000/(6.28\sqrt{1{,}000{,}000}) = 1000/(6.28 \times 1000) = 1000/6280 = 0.159$ Mc = 159 kc.

From Equation (1), other useful equations may be derived for finding C when L and f are known, or L when C and f are known. Thus:

(2) $C = 25{,}281/(f^2L)$

and

(3) $L = 25{,}281/(f^2C)$

Example 7. Equation (2). The capacitance (uufd) required to tune a 6-microhenry coil to 14 Mc is:

$C = 25{,}281/(14^2 \times 6) = 25{,}281/(196 \times 6) = 25{,}281/1176 = 21.5$ uufd.

Example 8. Equation (3). The inductance (uh) which will be tuned to 4 Mc by a 150-uufd capacitor is:

$L = 25{,}281/(4^2 \times 150) = 25{,}281/(16 \times 150) = 25{,}281/2400 = 10.5$ uh.

Impedance, Loading, LC Relationship

The impedance (Z) of the parallel resonant circuit typical of tanks is equal to the product QX, where X is the reactance of either the coil or capacitor at resonance. Since at resonance, as already shown, the net reactance is zero, the impedance is resistive. It is obvious from the foregoing that high impedance necessitates high Q.

Example 9. The resonant parallel impedance of a tank circuit having a 5-millihenry coil ($X_L = 31.4$ ohms), a 56-uufd capacitor ($X_c = 31.4$ ohms), and 4 ohms resistance may be determined as follows:

$Q = X/R = 31.4/4 = 7.85$

$Z = QX = 7.85(31.4) = 246.5$ ohms

Tank impedance reaches its maximum value at resonance. It is low at points above and below resonance because either X_c or X_L at those frequencies is dominant in the circuit, the net reactance used in the expression QX then being lower than maximum X_L or X_c.

Since power is transferred from a transmitter tank by loading, the effect of loading upon tank characteristics is important. When the power dissipated in a resistive load coupled to the tank is high, compared to that lost in the tank circuit, as is common in transmitters and industrial r-f equipment, the equivalent parallel resistance of the tank (and also its resonant impedance) is equal very nearly to the load resistance value. The effect of the load resistance can be shown as an equivalent parallel resistance, R, in Figure 2. The loaded tank-circuit Q then is equal to Z/X, where Z has the same value as R_L, and X is the reactance of either the capacitor or coil. Thus, in a hypothetical case, at 30 Mc the Q of a tank containing 50 uufd and 0.56 uh, and loaded with 2500 ohms resistance would be determined in the following manner:

Example 10. $X_L = X_c = 105$ ohms. $R_L = Z = 2500$ ohms. $Q = Z/X = 2500/105 = 23.8$

It is evident that many different combinations of L and C will resonate at a given frequency. At any frequency, the product LC is constant and is equal to $25{,}281/f^2$. For high Q of a resistance-loaded tank, however, high capacitance and low inductance make the most satisfactory low-reactance combination. The reason for this is apparent from the Z/X relationship. Tank circuits are termed high-C when the ratio C/L is large, and low-C when C/L is small. However, these are rather loose terms and, like Q, defy blanket numerical definition as to high and low acceptability, since many factors associated with individual operation must be considered. Nevertheless, it is well known both in theory and practice that a tank in which L is very high

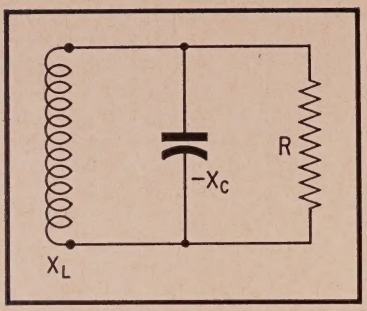

Fig. 2. Equivalent Circuit of Tank Delivering Power to Resistive Load.

with respect to C (high L/C ratio) will not deliver power efficiently and will generate harmonics, and that an extremely low L/C ratio gives rise to poor efficiency due to large tank circulating currents.

Plate Tanks in Class-C Amplifiers

The flywheel effect of the tank circuit is utilized in class-C r-f power amplifiers and frequency multipliers to convert to sinusoidal energy, at the operating frequency, the pulse-type energy supplied by the power tube.

Suppression of harmonics in the output waveform is important in maximizing efficiency and in preventing interference to higher-frequency services. A study of harmonic output vs. tank-circuit Q reveals that the Q must be at least 15 for effective 2nd harmonic suppression.

When the tank circuit is coupled to a resistive load to which it delivers power (the antenna, in the case of a transmitter), the effective Q is lowered by the increase in effective resistance of the circuit. See Figure 2. The Q can be varied by a ratio of several hundred to 1 by varying the load coupling, and can be adjusted to the desired value of 15 (with the tube operated at its normal plate voltage and loaded d-c plate current) only if the tank-circuit C/L ratio is correct at the operating frequency.

Assuming the peak r-f plate voltage swing to be not more than 15 percent lower than the d-c plate voltage, and the class-C plate-circuit efficiency to be between 70 and 80 percent, X_L and X_c each is equal approximately to $E_p/(2QI_p)$. In this expression, d-c plate voltage (E_p) is in volts, and loaded d-c plate current (I_p) in amperes. E_p/I_p is the d-c resistance presented by the tube to the power supply and may be designated R_{dc}.

Example 11. An 807 tube is to be operated at 600 volts, 85 ma dc when fully loaded at 14 Mc. The tank circuit Q is to be 15.

$R_{dc} = E_p/I_p = 600/0.085 = 7059$ ohms

$X_c = R_{dc}/2Q = 7059/30 = 235$ ohms

$C = 10^6/(6.28fX_c) = 1{,}000{,}000/(87.92 \times 235) = 1{,}000{,}000/20{,}661 = 48.4$ uufd

This is the **total** capacitance to resonate the tank coil at 14 Mc. If a manufactured coil is used and it is too large, turns must be removed until resonance occurs exactly at the calculated value of 48 uufd.

The amateur handbooks contain charts in which R_{dc} is plotted against total tank-circuit capacitance (C) for the several amateur frequency bands. Use of such a chart saves the labor of calculations such as Example 11. An example of such a chart is found in **The Radio Handbook,** 13th Edition, page 159.

The value of capacitance selected from a chart of this type is the **total** capacitance which should be in the tank circuit. This includes the tube output (plate-to-cathode) capacitance and all stray circuit capacitance in parallel with the tank circuit. This value is correct **per se** only when the

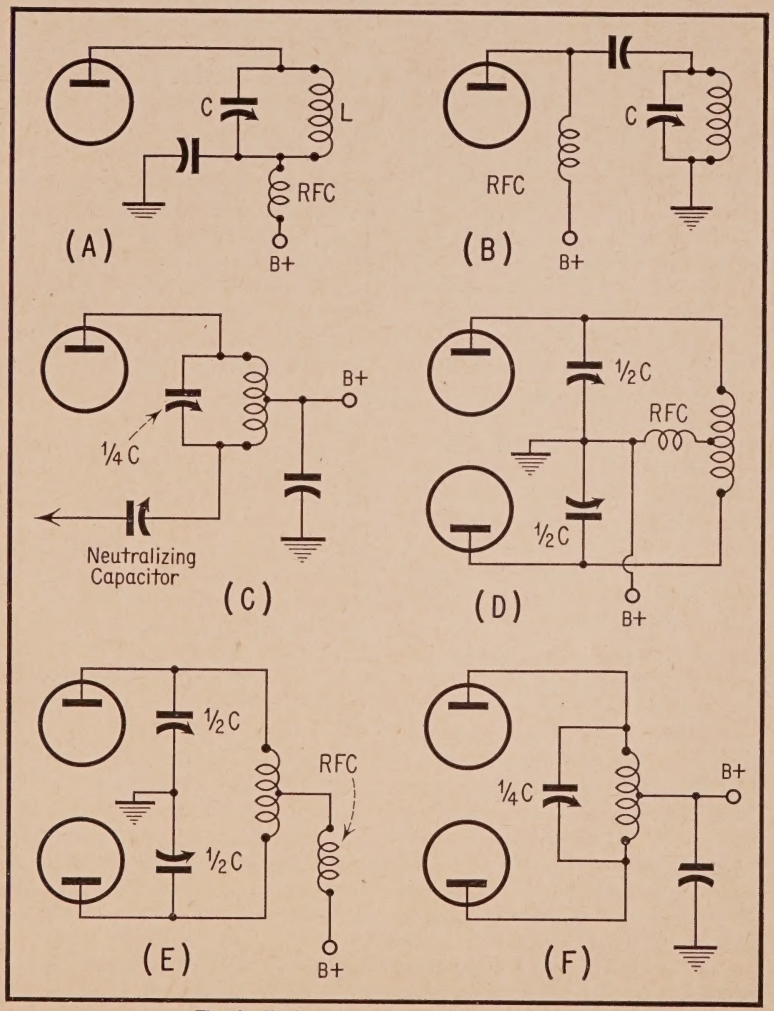

Fig. 3. Typical Tank Circuit Arrangements.

tube is in parallel with the entire tank circuit, as in the circuits in Figures 3(A) and 3(B). In other arrangements, as in Figures 3(C) to 3(F), the capacitor will have one-half or one-fourth of the capacitance value located in the chart — or calculated.

What voltage spacing should the capacitor plates have? A good rule of the thumb is to consider the peak r-f voltage across the tank capacitor to be equal to the d-c plate voltage (E). When the d-c voltage also is applied across the capacitor, the peak r-f and dc are added to give 2E. Thus, the voltage across the capacitor is equal to E in Figures 3(A) and 3(B), while it is equal to 2E in Figures 3(C) and 3(F). It is equal to E across each section of the dual capacitor in Figure 3(D), and to 2E across each section in Figure 3(E). When the r-f amplifier is plate-modulated 100%, all of these voltages must be doubled, since both d-c and peak r-f voltages double under 100-percent modulation. The circuits in Figures 3(D), 3(E), and 3(F) may be of either the neutralized or unneutralized type.

As a practical illustration, consider the pushpull circuit of Figure 3(E). This circuit often is used in compact transmitters where direct grounding of the capacitor rotor-frame is desirable. (1) Each section of the split-stator capacitor will have ½ the capacitance determined by means of the formulas used in Example 11 or found from a handbook chart. (2) In c-w telegraph service, the plate spacing in each capacitor section must be sufficient to withstand twice the d-c plate voltage. If $E_p = 1500$ v, for example, 3000-volt spacing must be employed. (3) If the circuit is to be plate-modulated, this value must be multiplied by 2, which means that each capacitor section then must have 6000-volt spacing.

Plate Tanks in Class-B Amplifiers

Lately, the class-B linear r-f power amplifier, formerly found only in some commercial radiotelephone installations, has become important in boosting amateur single-sideband signals.

The load impedance for such an amplifier is given by the expression E_p/I_p, where E_p is the peak fundamental plate voltage, and I_p the peak fundamental plate current (loaded). This value of R_L may be used as E_p/I_p in the calculations in Example 11 (or in consulting a handbook table) to determine the proper value of tank-circuit capacitance to use for a desired Q. The capacitance then may be modified, with the aid of Figure 3, depending upon which type of amplifier circuit is to be employed.

A practical procedure sufficiently accurate for this purpose, as given by Dawley (Radio Handbook, 13th Edition, page 265) assumes E_p to be 90 percent of the d-c supply voltage and requires that a reasonable peak power output (P) be assumed for the class-B tube to be used. From this, $R_L = (0.9E_p)^2/2P$.

It is easy to see that since $X_L = X_c = R_L/Q_L$, the required reactance for a Q of 15 would be $R_L/15$ or $(0.9E_p)^2/30P$. From this, the required capacitance could be determined in the following manner:

$$(4) \qquad C = \frac{10^6}{6.28f(0.9E_p)^2\ 30P}$$

Here, C is in uufd, f in Mc, E_p in peak volts, and P in peak watts.

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FOR SALE — Williamson ultra-linear amp. and power supply; Acro-Sound T-300 xmitter; Heathkit pre-amp. WA-P1. John H. Oxrieder, 5018 Elm St., Bethesda 14, Md.

FOR SALE — Heathkit V4A VTVM, complete assembly including fused plug, DC isolation probe and instruction manual. Perfect operating cond., $30 plus shipping. William Levine, 216-69 68th Ave., Bayside 64, N. Y.

FOR SALE — Hallicrafters SX-71 and R-46 speaker in good cond., $175 cash, or best offer. Kenny Kern, Bedford Municipal Airport, Bedford, Ind.

FOR SALE — Eighteen volumes of Riders Trouble Shooters Guides to volume XXI, $65. H. Gathercole, 45 Aberdeen Dr., Huntington, N. Y.

WANTED — Lampkin 105B frequency meter and 205 modulation meter. Must be in good cond. and priced for quick cash sale. Fitzgerald Communications service, 211 South St., Minden, La.

FOR SALE — Kate power-plant. HD unit on solid cast iron base 500 w. 110 v. AC 60 cy. gen. driven by Briggs-Stratten 1 1/2 hp. gasoline engine, $125. John Sporna, Escatawpa, Ala.

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FOR SALE — Philco 7008 TV alignment set, scope, crystal calibrated marker and sweep, plus 400 cy. audio, new cond. Make offer, or will trade for good commercial rcvr. R. C. Frank, 4908 Hersholt Ave., Lakewood, Calif.

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WANTED — Radio for 1950 Plymouth; 16" transcriptions: cheap motor and a good motor to play discs on. Harvey White, 1105 Waller Ave., Winnipeg, Canada.

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FOR SALE — Sprague KT-1 Kwik-test capacitor checker, perf. cond., $25 FOB. Stephen Plauski, 425-3rd St., Brooklyn 15, N. Y.

FOR SALE — Hornung and McKenzie's "Radio Operating Questions and Anwers" 11th edition, new cond. Will postpay in U. S. for $3. Charles Culley, Melville, La.

SELL OR TRADE — Precise 300 7" scope; Precise 111 mutual conductance and Emission tube tester, complete with attachment to test picture tubes; Solar 5" x 7" enlarger. Allan W. Seeley, 48 Elm St., Danvers, Mass.

SELL — Rider's Manuals, 11 to 14; Sam's Manual, 1 and 2. All in exc. cond., with indexes, $10 each, plus transportation. T. B. Winstead, Box 365, Elm City, N. C.

FOR SALE — Webster-Chicago 356-1 automatic, three-speed record changer, good cond., metal base, $25 or best offer. William Fine, 286 Marston Ave., San Francisco 12, Calif.

WANTED — Sam's PF index 34 and 37. Will pay reasonable fee if in good cond. W. F. Montgomery, Jr., 3958 Baltic St., Jacksonville 10, Fla.

SELL — Astatic 400 pickup arm cartridge with good stylus included, $5.50; GE RPX-041 LP cartridge with good stylus, $2.75; VR preamp with tube, $3.95. All postpaid. E. W. Hill, 10 Plumtree Rd., Levittown, Pa.

SALE — 100-foot TV tower and antenna; Pentron tape recorder; Presto K disc recorder; long playing records, tape and other parts. Sacrifice. Collinsworth, 1147-35th St., Columbus, Ga.

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SELL OR TRADE — Riders vol. 2, 6, 7, 9, 12 and index; Beitman diagrams, 1926 to 1938, vols. 39 to 42, good cond. Want ham or photo gear or cash. W. D. Erickson, 12 Hampton Ct., Spartanburg, S. C.

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FOR SALE — Rider's radio manuals; Sam's photofacts; ICS electronics course; Precision 620 tester; radio and TV books; Popular Science; Popular Mechanics; Mechanics Illustrated; Service, Technician; Hickok 19XD sig. gen.; radio tubes. T. Wojciechowski, 2837 Fulton St., Brooklyn 7, N. Y.

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SWAP — Back issue of NRI News, Oct. '38 to May '55; C-D Capacitor, Jan. '50 to May '55 for small printing press. T. C. Coughlin, 441-42nd St., Brooklyn 32, N. Y.

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FOR SALE — 1800 rpm, 220 v., 3 phase, 60 cy., 60 kw, AC gen. less DC, exc.; 15 hp Elec. Mach. Mfg. Co. sync. motor. Best offer, George Dvorak, Montgomery, Minn.

FOR SALE — Microphone model 731 Electro-Voice Dynamic Cardyne model II streamlined satin - chrome, adjustable head with switch, desk stand cable, etc. Fine cond., $20 or best offer. H. Taylor, 3234 Fernside Blvd., Alameda, Calif.

FOR SALE — Unused UTC xformer LS-58, push-pull parallel 6B4's, etc., output to line and voice coil. Francis Pott, 3006 16th Road South, Arlington 4, Va.

SELL — Forty perfect tubes, $25 plus postage. Closing out shop. Vern Worden, Friend, Neb.

SELL OR TRADE — 500 w. 813 phone rig, 5 type 616 doublers, band switching except for final, 811's push-pull modulators, 2 power supplys, all in metal cabinets, $225. T. Williams, 105 Elm St., Ypsilanti, Mich.

SELL — Complete DeForest radio course, 60 books, $15 COD only. R. Harding, Box 1, Newton 58, Mass.

TRADE — Riders vols. 1 to 5, in individual volumes, 6 to 21 plus PA volume, for sporting firearms. George's Appliances, Box 464, Uleta, Fla.

SWAP — ½ hp 125v. and ½ hp 115 v. DC motors; aircraft rcvr. with 24 v. power supply needs repair .5-1.5 mc.; 12" mounted perm. mag. speaker; old Fairbanks-Morse SW rcvr. Need ham equip. Roger Taylor, 4960 Crittenden Ave., Indianapolis, Ind.

FOR SALE — 300 w. 40-80 meter xmitter with VFO, 813 final, 4 power supplies, ant tuner, tubes, condensers, modulator, and misc. parts. H. E. Leigh, Sr., 197 North 14th St., San Jose 12, Calif.

WANTED — Belmont AC table model 529 radio, any cond. Need two gang condenser and 5 push-button assembly. Uses 5Y3 6A8 6K7 6K6 6Q7. State price. Clarence E. Zink, 269 North York St., Elmhurst, Ill.

FOR SALE — Model 670 Superior VOM and Test-Rite B-45 sig. gen. (needs batteries). Lewis E. Telford, 209 East Hampton St., Anderson, S. C.

FOR SALE — 810 amplifier; 810 tubes; Johnson Condensers; parts for 2000-2500 v. power supply, $75. Milton Tauscher, 3831 Taft St., Gary, Ind.

FOR SALE — 142 radio tubes, many in original cartons. Send for list. Make offer. R. E. Davison, Harvard, Neb.

FOR SALE — National 697 rcvr. power supply, same as 5886 except for 25 — 60 cy. operation filtered for 25 cy. operation on 60 cy., $8. N. L. Parker, 1240 Bedford, Detroit 30, Mich.

WANTED — Hi power xformer 2500-0-2500, 500 ma., chokes, filter condensers (810 tubes). Have cash or trade 2.1-3 mc. ARC-5 xmitter; 3-4 mcs. ARC-5 xmitter; 30-40 mcs. fixed freq. rcvr.; tubes, etc. David Howerdel, 223 Terrace Ave., Jersey City, N. J.

FOR SALE — (5) 0-15 v. AC Westinghouse 3" rd. meters, $3.50 ea.; (5) 100-0-100 ma. meters 3" rd., $4.75 ea.; (5) 2 mfd 2500 v. DC cond., $2.75 ea. S. S. Brody, 211-10 73rd Ave., Flushing 64, N. Y.

SELL OR SWAP — Special purpose tubes, GL-5725, 6AN5, 2-5638's, 3-5718's, 2-5840's; Diodes, 1N23A, 1N27, 2-1N34A's, IN44, 3-1N47's, 2-1N60's, 1N81. Best offer or trade for Kelsey press. Anthony E. Szempruch, 1024 W. Pleasant St., Springfield, Ohio.

CASH OR TRADE — For Jackson CRO-2 scope, TVG2 sweep and marker or equal. Have Johnson 2½ hp. motor, 3" DeForest scope and many other things for trade. Irving E. Frost, 643 Crescent Ave., Rumford, Maine.

SELL OR TRADE — Stock unused parts, 150 tubes, speakers, xformers, pickup, etc., Weston 772 meter, Ts-3A Elect. stethoscope A1 cond. Job lot $100. Typewriter tools including leather case for VTVM. Stanley Smith, 1853 N. Morgan, Decatur, Ill.

FOR SALE — Over 500 Standard brands tubes mostly older types in orig. cartons. What do you need? Olson's Electric Shop, 508 Broadway, Everett, Mass.

FOR SALE — Hammarlund, HQ 129-X, comm. rec., matching spkr., orig.nal owner, excellent cond., $110. E. J. Dunn, 644 Clarence Ave., Bronx, N. Y.

FOR SALE — Vibrapack VP552, 6 v. to 225, 250, 275, or 300 v. at 100 ma., old but unused, $10 plus transportation. T. Macomber, 206 Jordan Ct., Los Altos, Calif.

SALE — Hickok 195B 5" scope, $125; Precision 612 tube checker, $75; Precision EV-10S, $59.50; Jackson 420 sig. gen., $65; ED-100 VTVM, $27.50; Simpson 260, $30. Scott Radio Service, Benld, Ill.

SWAP — Improved Eico 320 sig gen.; EMC 102 with test leads; good UV-201 and UV-200; old QST 1920-1925; books; .039 "cub," 12 sta. master intercom, for ham gear, service equip., cash, or ? John M. Hicks, 1136 Margray, Pittsburgh 7, Pa.

FOR SALE — 10 w. amplifier with tubes, $15; Jerrold TV antenna distribution outlets, $5 each; RCA WV-97A senior voltohmyst plus WG-264 demodulator crystal diode probe, $45, A1 cond. Soundcraft Prod. Co., 9 Kelly Square, Worcester 4, Mass.

FOR SALE — Radio-Phono; Wilcox-Gay Tape Recordio; DeForrest Radio TV course; Weston light meter movie camera. J. L. Madden, 351 West 44th St., New York 36, N. Y.

WANTED — Capacitor, resistor, tester, and VTVM. Must be A1 cond. State price. Joseph Lishok, 683 Mountain Ave., Pomona, Calif.

WANTED — Low cost xmitter on phone or key. Garth Nash, Box 295, Wheeler, Texas.

FOR SALE — Philco 200X external UHF convertor, mahogany cabinet, never used, original carton. Quote offer. G. E. Howarth, 216 1st Ave. E., Oskaloosa, Iowa.

FOR SALE — NRI spring wound code sender complete with hi-freq. buzzer, practice key, and 9 double sided tapes, $10, cash only. J. W. Eckenwiler, 1664 Betz Dr., Akron 6, Ohio.

FOR SALE — Small prop-pitch motor complete with 28-30 v. xformer, modified, 3/4 rpm, $25, complete. H. Ruffalo, 14 Center Ave., Cedar Grove, N. J.

URGENTLY NEEDED — For civilian defense installation, manual and or schematics for xmitter T-67/ARC-3, rcvr. R-77/ARC-3. Will pay reasonable price. F. C. Hervey, Chilton, Wis.

TRADE — 200 w. 40 meter phone xmitter class "B" audio, professional appearance, completly tvi'd for complete mobile rig. T. S. Trimmer, 53 S. Bedford Rd., Mt. Kisco, N. Y.

FOR SALE — Slightly used 100X, 200X and 300X turrett micro scope with original hardwood case and 5 slides. Sandy Gant, 1178 Eastern Parkway, Brooklyn 13, N. Y.

WANTED — Johnson "Matchbox" ant. coupler. State cond. and price in first letter, Eddie Gigliotti, 249 So. Main St., Bangor, Pa.

WANTED — 10 to 25 w. amplifier, 3-speed changer, or AM-FM tuner, speaker — cabinet not necessary. Quote lowest cash price on any or all. Will consider a kit. C. Gabler, 1307 Merriam Ave., Bronx 52, N. Y.

FOR SALE — Ferris 32B radio noise meter with rectifier pack for 115 v. 32-U1. Working and in exc. cond., $300. Irwin Electronics, 1810 West Ogden Ave., Chicago 12, Ill.

FOR SALE — Mark II xmitter-rcvr., $20; Stancor 110CM 100 w. fone-CW xmitter, $50; Triplett 2413 tube tester, $22.50; Bogan Sound System p.p. 6L6 output, 2 speakers, $25. G. F. Hutchinson, 618 4th St., Bemidji, Minn.

SELL OR TRADE — National 110A with all coils, EE8B, all-band xmitter with 807 and coil turret final, receiving and xmtg. tubes, parts, xtals, coax, etc's. Want 2 motor and aircraft gear. Bob Townsley, 5919 Almaden Lane, Oakland 11, Calif.

SELL OR TRADE — Radio tubes, parts, manauls for cash, or old magazines and books on cars. Harold Garrett, 711 South New York, Sedalia, Mo.

FOR SALE — 5 x 8 press, $40; DeVry Radio and TV course, $35; Rider radio manuals, $3 each. P. Ferrina, 4309 Kansas Ave. NW., Washington 11, D. C.

FOR SALE OR EXCHANGE — GE self-charging portable model 250; Bendix 3-way portable; Hallicrafter S-19; etc. Want 7, 10 or 12" TV; test equip.; tubes; guns; or what have you? E. G. Bartlett, Atlanta, Mo.

FOR SALE — Precision ES-500A scope and probe kit; Pentron 2-speed tape recorder, used two months. Dick, Box 267, Schuylkill Haven, Pa.

FOR SALE — Tape recorder, Pentron TR4, l. n., come, hear, and take it for $105. Freedman, 144-34 72 Drive, Flushing, L. I., N. Y.

WANTED — Lampkin meters, or Measurements Corp model 80 or 82 sig. gen. and 2 way test equip. R. Phillips, Box 8136 Plaza Station, Kansas City, Mo.

FOR SALE — Eico tube tester 625, $35; Eico VTVM, $25; Mallory battery eliminater 6RS10, $20. All l. n. Gerard Zara, 22 Stone St., Newark 4, N. J.

SELL OR TRADE — Complete mobile rig, Elmac AF67, Gonset super-six converter, noise limiter, PE103 dynamotor, all band antenna, cables and relays, $200 or good rcvr. (SX-71 or HQ-140X) or better. James F. Grimaud, 317 N. State St., Clarks Summit, Pa.

FOR SALE — TV chassis: 10" and 12" Philcos, Raytheon, others, good for parts. T. Wasek, 106 Beech St., Rutherford, N. J.

FOR SALE — 35 w. ham xmitter (home built), Hallicrafters S-38C, Wilcox-Gay tape-disc 3C10 recorder, remote TV pickup. E. R. Macke, 913 Oak St., Indiana, Pa.

FOR SALE — HV Mica condensers; DC and AC meters; low voltage chokes and power xformers; MB-150 National turret. J. E. Struthers, Box 112, Morrisonville, N. Y.

FOR SALE — Craftsman C-10 FM-AM tuner, $80; C-500 Craftsman-Williamson amplifier, $60. Both in perf. cond. S. D. Kaufman, 179 Rawson Rd., Brookline, Mass.

INFORMATION — Can supply information on characteristics, use, size, cost, etc., of many types of AN and TS surplus electronic equipment. S. Consalvo, 4905 Roanne Dr., Washington 21, D. C.

WANTED — Instructograph code machine, electric model, built-in oscillator and practice tapes to 18 W.P.M. State cond. and lowest cash price. B. Norkus, Box 13535, Dallas, Texas.

WANTED — Schematic or service manual on Operadio 699A amplifier. William Barber, 309 Alexander St., Youngstown, Ohio.

WANTED — HRO-60 plug in coils E and F. Write Paul Reynolds, 63 Oswego St., Baldwinsville, N. Y.

WANTED — Transformer and xmitter in good cond. Must operate on 45.07 or easy convert to it for C.A.P. mobile use on 6 v. R. W. Reaney, 216 Carter, Ottumwa, Iowa.

WANTED — Heathkit or similar VTVM, must be bargain-priced. Will pay cash. John Lellelid, Colman, S. D.

WANTED — Used portable or other 2 or 3 speed disc recorder, with radio-phono outfit. Will sell 15" Jensen Coaxial Imperial reproducer; model "L" Hammond Solovox and cases. Walter William Tritchler, 293 W. 7th St., St. Paul 2, Minn.

TRADE — Hickok sig. gen., VTVM, tube checker, etc., all late models, for photo equip. Oscar W. Faulk, Box 543, Monroe, N. C.

FOR SALE — Life-long battery with 10-year guarantee; Heath TS-3 TV alignment sweep gen. and sig. gen. SG-6; high voltage probe 30,000 v.; Electronics books and manuals; portable AC-DC battery radio. Stanley Bombka, 8107 N. Odell Ave., Niles 31, Ill.

FOR SALE — NRT complete radio and TV course, 66 lessons, $45. Walter P. Ebner, 1813 So. Michigan Way, Denver 19, Colo.

WANTED — McMurdo Silver model 701 xmitter, low power 6-meter phone transmitter. John C. Strole, 18 Cooper Pl., Weehawken, N. J.

FOR SALE — Johnson Viking VFO, complete, accurately calibrated, $45; Hickok CRT test adapter, $5; Perma-Power Hor. bar gen., $1. J. O. Turner, Box 37, Homer, La.

FOR SALE — 250 standard brand radio and TV tubes in original cartons. Will sell all or part; Jackson 636 tube tester, $20. W. D. McCaughey, 14012 Gilmore St., Van Nuys, Calif.

WANTED — National or Hammerlund rcvr, complete details first letter. Cash or swap telescope and Heath AR-2 both like new. Kenneth G. Davis, RFD 4, Box 761, Annapolis, Md.

FOR SALE — Like new Sylvania 400 7" scope, $165 and Simpson 479, sweep and marker, $210 or both for $350. F. J. Hanzel, 303 Pearl St., Sioux City, Iowa.

FOR SALE — Pentron PMC Hi-Fi tape recorder, $60; Garrard model T with base, $20; Bogen R-701 FM-AM tuner with compensator and loudness control, $80. L. Brown, 237 So. 2nd St., Brooklyn 11, N. Y.

FOR SALE — Hickok VTVM 203, $35; Weston VOM 665 type 2, $20; Eico sig. gen. 320, $15. G. S. Garrigan, 357 Plymouth Rd., Union, N. J.

SELL OR SWAP — Radio control equip. in citizenship band 27.255 mc., xmittter, rcvr., and Servel unit also plane without engine for $60 or ham gear. I. W. Lasher, 171 Linwood Ave., Buffalo 9, N. Y.

WANTED — To correspond with and exchange tapes with owners of recorders. O. J. Demarest, 89 West St., Green Island, N. Y.

FOR SALE — Back issues QST, Radio-CQ R9 break-in, Audio Engineering; RCA L-110 Viscaloid pick up, unused. Want BC-474. M. J. Douglas, 1401 Amador, Concord, Calif.

SELL OR SWAP — Mac Silver "Sparx" loading coil, 16 pc. unused Dietzgen sig. tracer, Master mobile 20 meter drafting set in zipper case for cash or electronic gear. R. J. Feigenbaum, 708 West 171st St., New York 32, N. Y.

FOR SALE — Like new Eico 214 VTVM with 7" meter plus RF probe, $40 and Eico 625 tube tester, $35; Feiler TS-3A sig. tracer, $20. Ray Arendt, 207 East Amherst St., Buffalo 14, N. Y.

SELL OR SWAP — Tubes, xformers, resistors, condensers, magazines, books, speakers, power shifter. Want electric handdrill, also 1/4 hp. bench motor or what have you? Enclose self-addressed stamped envelope. J. S. Chanin, Box 11A, Beulah, Mich.

FOR SALE — RCA 630 17" TV, complete, without cabinet, good cond. Joseph Baruch, 207 Ross St., Brooklyn 11, N. Y.

SWAP — Good LM-14 freq. meter with original calibration book and crystal; 10 kc. - 200 kc. freq. Standard (110 v.), TA-12D xmitter, Supreme 504A tube checker, all in exc. cond., need portable typewriter, Kodak 300, 500 w. slide projector, or cash. Robert R. Jessup, Vandalia, Ill., R. 2

WANTED — FM crystal control rcvr. on 30 to 50 mc., in good operating cond. H. H. Riley, Rt. 4, Box 346, Aiken, S. C.

WANTED — Manual for McMurdo Silver 900A Vomax VTVM. Will buy or swap radio parts. Howard Keller, 610 Ocean Park Ave., Bradley Beach, N. J.

SELL — Pilot 3" TV, $45, exc. cond. Also guns of all kinds. John Greene, Box 84, Canfield, Ohio.

TRADE — Unused 804's, 211's, 304TL's, 833A's, 450TL's, 128A's for NC-183D, SX88, k.w. xmitter, power supply in good cond. What have you? Alex Hodge, Box 3221, Eastchester, Anchorage, Alaska.

FOR SALE — Established radio and television sales and service business in the heart of down town Charlottesville, Va. Radio Service Co., 117 Second St. NW., Charlottesville, Va.

FOR SALE — 6 tube coin operated radios, wood cabinets, operate 1 hr. for 25c, guaranteed, $12 ea. FOB. Brown Taylor, 1307 Vultee Blvd., Nashville, Tenn.

FOR SALE — 2 Gonset 2 meter converters, l. n., complete with steering column brackets, $25 each. E. C. Pearson, 2715 Piedmont Ave., Duluth, Minn.

FOR SALE — Superior LTV-11 tube tester, A-1 cond., $37 and Superior 770 VOM, $7, plus shipping charges. A. Delmarty, 142 Fir Ave., So. San Francisco, Calif.

SELL OR TRADE — BC-611 rcvr. xmitter, extra tubes and crystals complete. Need modern conductance tube checker or? Robert L. Keisel, Rt. 2, Box 200, Arlington, Texas.

FOR SALE — 6 Allied 8000 ohm Differential Plate Circuit Relays, 2 normally open contacts per coil, $1.50 ea. COD. S. S. Brody, 211-10 73rd Ave., Flushing 64, N. Y.

WANTED — Bliley crystal liner. Advise price and condition. J. R. Chaney, 209 W. Rockwell St., Elkhorn, Wis.

SELL OR SWAP — No. 19 Mark II xceiver, BC-458, BC-459 transmitters unaltered, unused 5CP1 scope tube. Want test equipment or ham gear. K. R. Gray, 216 So. Ogden Ave., Columbus 4, Ohio.

FOR SALE — Proceedings of IRE, uninterrupted set from December 1943 to present, exc. cond., $30. S. O. Levin, 1358 President St., Brooklyn 13, N. Y.

SELL — Modern electrical engineering, physics, and applied mathematics, used textbooks. Send stamped, self-addressed envelope for list. R. C. Howard, 48 Stevens Rd., Clifton, N. J.

TRADE — Radio-TV course for watch and clock repairing course. L. Matejzel, 2245 Farragut, Chicago 25, Ill.

FOR SALE — Compact low power xmitter, built-in modulator and power supply for 110 v. AC or DC. Shipped prepaid with tubes, 40 and 80 xmitter coils, $29.50. Mike and xtals not included. J. C. Newsome, 2411 S. Hawthorne Rd., Winston-Salem, N. C.

FOR SALE — Edison's cylinder phonograph, with 82 cylinder records. Make offer. M. Francis, 10244 Bensley Ave., Chicago 17, Ill.

WANTED — Bell and Howell 12" speaker, No. 07768 for Filmosound 285. State cond. and price. Horace O. Pease, 144 Manson Ave., Kittery, Maine.

WANTED — Sams Photofacts in folders or binders, single or more. Write stating numbers, cond., and price. Frank Plonka, 101 Hadwin St., Central Falls, R. I.

WANTED — Western Electric 618A moving coil microphone and any good quality recording head such as Presto 1-D or Audak Cutter. Sell or swap over 300 16" electrical transcriptions. J. F. Geilenkirchen, 4 Stewart Pl., White Plains, N. Y.

WANTED — Used tape recorder, 8 mm silent projector, 16 mm sound, outdoor PA system 6-12 v., battery eliminator, VTVM, scope. For cash or trade Hi-Fi equip. Marcello Valenzano, 33-02 Union St., Flushing 54, L. I., N. Y.

SWAP — Ham xmitting gear for ham rcvr. J. V. Jacksa, 1318 Bates Rd., Oakland 10, Calif.

FOR SALE — Entering college, must sell unused Heath V-7 VTVM, $37.50; Philco 152-162 mcs. mobile rcvr.; O-1 DC milliameter; QST magazines; etc. Richard L. Evans, Jr., Box 28, Ambler, Pa.

FOR SALE — Jerrold preamplifiers for hotel or community TV systems, base and 2 4 and 6 strips also preamps 3-6 and 10, $250 complete. Harry L. Sharp, 412 Centre St., Ashland, Pa.

FOR SALE — Dage 100-A closed circuit TV camera in exc. cond. Complete with tripod, normal, wide angle, telephoto lens, and constant voltage transformer. D. K. Crittenden, 1722 Kalamazoo SE., Grand Rapids, Mich.

FOR SALE — Riders, GI motors, Simpson panel meters, Triplett panel meters, Bud chassis, Mallory switches, vibrators, Stancor and Thordarson transformers, Meissner coils, etc. R. C. Parker, 722 Market St., Philadelphia, Pa.

SELL OR TRADE — Audax cutting head, model 8X and Western Elec. Instrument Co. AC voltmeter 0-150 v. both in very good cond. Want tape recorder, Hi-Fi or test equip. S. Albert, R. 1, Box 1327, Vista, Calif.

SELL — 3 MFD v. DC filter condensers with bracket from BC-160, $6; 2 MFD 4000 v. DC, $5; B & W Butterfly CX58, .375" spacing unused, $13. Want tape recorder, Hi-Fi amplifier. Macy, 2346 Dundee Rd., Louisville, Ky.

FOR SALE — Supreme TV manuals 2 to 8, each $2.25; Precise test kits, VTVM 909, $23; VTVM 9071, $33; high voltage 999 probe, $5; RF 912 probe, $3. G. D. Griffin, Box 590, Rome, N. Y.

TRADE OR SELL — Radio, ham parts, and tubes for 2 meter antenna rotor, 6 meter converter, all band whip with loading coils, 100 ft. 52 ohm coax, 40, 80, 15, 2 meter crystals. W. Barry, 1229 Edgehill Rd., Darby, Pa.

SELL OR TRADE — Power supply for rack mounting 1750-0-1750 v. AC 400 ma. DC CCS; BC-459 xmitter partially modi., calibrated bandspread dial, spare tubes, instructions, mounting; RCA Radiola-33. Want FM tuner. H. E. Wood, 451 Manor Rd., Hatboro, Pa.

WANTED — Hallicrafters SR-75 10 w. xmitter-rcvr. combination. Also any other lightweight, compact xmitter for 75 meters CW or phone. Must be in good operating cond. E. Harvey Cunningham, P. O. Drawer H, Rio Grande City, Texas.

FOR SALE — 24 Mallory small single section, rotory switches, Cat. No. 3226J, one circuit, 12 positions, non-shorting type, 2" shafts, in perf. electrical cond. 6 switches for $2.50 Postpaid. L. Cohen, 151-09-34th Ave., Flushing 54, N. Y.

SWAP OR SELL — BC-6S4 complete, RCA 3" scope, 522 rcvr., Sperti 2 meter walkie-talkie, Pentron tape recorder. L. Meister, 321 River Rd., Nutley, N. J.

FOR SALE — Millen unused 92101 preamp, Hewlett-Packard 200-B audio osc., P.P. 6V6 modulator, Theremin, Hi-Fi records in exc. cond. Raoul Drapeau, 1346 Bridge St., Dracut, Mass.

WANTED — Selector switch from defunct Weston 665 selective analyzer. Also want two Handie-Talkie Chassis. Donald Cameron, 1619 Milburn Ave., Toledo, Ohio.

WANTED — Commercial xmitter 1000 w. AM or FM. D. Baugh, R. 1, Box 524, New Augusta, Ind.

SELL OR TRADE — Eico 322 sig. gen. in good cond., $18 postpaid or what have you? Bob's TV, 38 Oberlin St., Buffalo 11, N. Y.

SELL OR TRADE — Supreme 504 tube tester, Radio City Product 315 tube tester, and Buick car radio. Harold Wurm, 1015 W. Grant St., Appleton, Wis.

FOR SALE — Transformer, filter chokes, vibrator type jig saw, 1. n. and Cornell-Dubilier set of capacitors, $40. Larry Melau, Star R. 2, Rhinelander, Wis.

WANTED — BC-625 xmitter portion of 522, unconverted or any cond. Bill Romain, 28 Avon Pl., Staten Island 1, N. Y.

SELL OR TRADE — Unused CW3 Wilcox rcvr, with 3.1 to 6.1 mc. coils and instruction book for mobile gear, BC-221 with original xtal and book or cash. J. Dieringer, 311 S. 7th St., Yakima, Wash.

FOR SALE — 500 w. phone, 600 w. CW xmitter; PP812H final with 300 ohm link coupling; 811A modulators; 40/20 meter coils, TVI'd in Bud deluxe cabinet, $300. Local only. Al Fayette, 4642 Copernicus St., New Orleans 14, La.

FOR SALE — Riders TV vol. 1-6; Riders Radio vol. 10-16; Riders TEK file 3, 5, 15, 18, 21, 27, 30, 44, 48, 51, $50. Harold's TV Service, 1354 Stfd. Ave., Bridgeport, Conn.

SWAP — Dozen each of channel 4 ten-element Yagis, channel 2 ten-element Yagis for five or ten element channel 6 or channel 10 Yagis. Dixie TV and Radio Service, 25 First Ave. NW, Moultrie, Ga.

SWAP — Like new Motorola 7XM AM-FM new tubes and Supreme 589 tube tester, for good used tape recorder with push-button controls 3¾ IPS or dual speed preferred. Gordon Parris, Hayesville, N. C.

SELL OR TRADE — GE model 250 self-charging portable, typewriters, 7 x 50 binoculars, Hallicrafter S-19R, Bendix 3-way portable. Want 10" or 12" TV, test equip. E. G. Bartlett, Atlanta, Mo.

SELL OR TRADE — Ham equip. Need converter; also stamps. Bill Grebe, 518 W. 9th St., Loveland, Colo.

FOR SALE — Bell and Howell filmosound 202 projector in original unopened carton, $525. Mac Thomson, 2470 Oak St., Eugene, Ore.

WANTED — Dope on model 585, serial 585-230, diagnometer. F. O. McMami, 2401 Hiawatha Park, Columbus, Ohio.

FOR SALE — Hickok 288X sig. gen. with cables and manual, l. n., $90. Edward Slusarski, 3520 W. 49th St., Cleveland 2, Ohio.

FOR SALE OR SWAP — Accordion with amplifier, also clavioline, (electronic musical instrument), reasonable. Jay Stemmerman, 8932-88th St., Woodhaven 21, N. Y.

FOR SALE — Army mine detector SCR625; Maher metal locator-duplicator. John Haynes, Doe Run, Mo.

WANTED — 75 w. sound system complete with 2 speakers and cable or three speakers less mikes. Will swap for 5" scope, sweep generator and marker generator or musical instruments. John Arnold, P.O.B. 84, Bluffs, Ill.

WANT — Collins 32V2 in trade for 310-B-3 5 ft. enclosed rack with 2 power supplies; pr. 4-400's; 10-300 mmf var. vac. cond.; 25 mh. Johnson var. inductance. Art Bonte, 3138 Kingsbridge Ter., Bronx 63, N. Y.

FOR SALE — Windcharger less propeller; Garage type GE battery charger; aluminum trumpets, Y-connector and driver. Roy G. Humphreys, Ballard, W. Va.

WANT — Band-switching phone xmitter. Swap for 1939 Ford station wagon, 1952 motor, A-1 tires. W. M. McDonald, 15 Joslin St., Providence, R. I.

WANTED — Sked with Delaware station, 20 or 40. R. A. Bristow, 1432 Heatherdale Ave., Santa Clara, Calif.

FOR SALE — Admiral 7" TV set, model 19A11S, chassis 19A1, in good cond. (see Sams PF No. 59 for description), $20. J. H. Schultz, 1225 Franklin, Springfield, Ill.

FOR SALE — Radio & TV two-man repair shop. Sell for stock, inv. and fixtures. H. A. Moore, 174 N. 2nd St., Coos Bay, Ore.

FOR SALE — Precision E-200-C sig. and marker gen. in perfect cond., $35. Samuel P. Fiore, 374 Bremen St., East Boston 28, Mass.

FOR SALE — Hi-voltage mica xmitting cond.; meters; MB-150 Turret, Hi-voltage filter cond., power xformers and filter chokes. Send self-addressed stamped envelope for list. J. E. Struthers, Box 112, Morrisonville, N. Y.

WANTED — Two GE S1201-D; 12 speakers. Will pay $10 each delivered. Eugene Roy, 5 Hillside St., Haverhill, Mass.

MUST SELL — Scope CR02, $140; condenser tester model 112, $45; VOM model 643, $25. All Jackson in exc. cond. with leads and instruction book. J. Schwartz, 2370 Euclid Hts. Blvd., Cleveland Hts. 6, Ohio.

SELL OR SWAP — Eico 145 sig. tracer, Eico 320 sig. gen. G. V. Wintriss, 13 Swarens St., Hutchinson, Kan.

SELL OR SWAP — Hickok Multi-tester model 550X; Weston model 788 tube tester. Swap for 16 mm films or equip. William Gorges, Atlantic, North Carolina.

WANTED — Sams manuals, vol. 5 to date; 6 and 12 v. batt. elim.; 5" scope; capacitor checker. Walter Fralick, R. 1, Marion, Ky.

WANTED — Coin boxes with clock for TV in motels, late tube tester with roll chart. Tubes to swap. Benny Mueller, Sanborn, N. Y.

FOR SALE — Oak Ridge picture tube checker, $5; Heathkit tube checker, $20. Will ship COD. Roland A. Staples, Main St., Eliot, Maine.

FOR SALE — Motorola auto radio model 309, $8. Clarence Hein, Route 4, Manheim, Pa.

SELL OR SWAP — Dumont 274 5" scope, $65; University 6201 speaker in reflex cabinet, $40; Electrovoice SP-8B speaker in RJ S8U enclosure, $35; 10" TV, $13, local preferred. Martin A. Weiner, 2927 Holland Ave., New York 67, N. Y.

FOR SALE — Latest radio, RCA, GE, Westinghouse, TV tubes, all numbers, orginal cartons, 30 per cent discount. Ben Cheskis, 2661 North Napa St., Phila. 32, Pa.

WANTED — Meissner model 8C FM tuner for cash, must be reasonable. Sam Nash, RD 2, Box 97, Mays Landing, N. J.

FOR SALE — NRI service manual Vol. I, most popular circuit diagrams and data by Rider, 1. n., $5 or trade. G. W. Arhart, Thief River Falls, Minn.

WANTED — Used tube checker in good cond.tion and reasonable, for cash. Louis Tenenbaum, 522 Ocean Ave., Brooklyn, N. Y.

WANTED — Selenium rectifiers for 130 v. under 100 ma. down to 65 ma., also bridge type up to one amp. 50 v. input. Trade radio or ham parts. Bob Eubank, 1227 Windsor Ave., Richmond 27, Va.

WANTED — Precision test equip., in metal case, scope, VTVM, sig. gen., sweep gen., tube tester. Late models and reasonable. K. A. Walls, 1119 Montello St., Brockton, Mass.

FOR SALE — Tower, galvanized, 35', including 2-element 20-meter beam, rotating motor, gears, bearings, relays, transformer, AC and RF cables and dual selsyn remote control-indicator. As is, $100, local only. L. M. Swingle, 4723-48th Street, NW, Washington 16, D. C.

FOR SALE — Oscilloscopes Tektronix types 315-D and 513-D; tape recorders Revere model T-100, Brush models BK-442 and BK-455-P "Soundmirrors"; CR tubes type 5CP1, 1. n., H-P model 400-A VTVM, used. A. R. Satullo, 2440 Kalama, Royal Oak, Mich.

POSITION WANTED — Graduate of RCA institutes, first radio telephone license, desires position in broadcast field or electronics firm as technican. General experience, will travel. George Demaris, 1258 Brook Ave., Bronx 56, N. Y.

WANTED — Johnson "matchbox" ant. coupler for cash. State price, cond. Eddie Gigliotti, 249 So. Main St., Bangor, Pa.

SALE OR TRADE — Pair of ML531 high voltage, high current rectifier tubes for electronic or photographic equip. In original cartons. Martin D. Johnson, 636 East 7th St., Alliance, Neb.

FOR SALE—Concertone 1501 tape recorder, good cond., 504 carrying case, Monitor speaker, $250. C. B. Pearlston, 323 Montclaire SE, Albuquerque, N. M.

FOR SALE — GE 3-way radio, portable, can be charged on house AC current, A-1 battery. J. Fox, 3511 Baring St., Philadelphia, Pa.

WANTED — J7 tube with F7 filament, RCA Cunningham or up to date equivalent for use in 1935 navigator table model. George B. Friendlee, 7457 N. Kenton Ave., Skokie 10, Ill.

SWAP — Remington-Rand Portagraph, Arkay rotary print drier, Carter Genemotor, Sky Buddy for antenna tuner, mobile equip. or what have you? W. T. Clark, Frances Dr., Greenwood Hills, Harrisburg, Pa.

FOR SALE — ES 500-Precision scope with test probes; E400 FM and TV sweep gen.; 630-Triplett 20M per volt VOM; battery eliminator 6 or 12 v.; Spraque condenser checker. John Poulios, 192 8th Ave., N. Y. C.

WANTED — 80 and 160 meter bandspread coils for National FBXA receiver, also general coverage coils, any frequencies. Cash or trade. George F. Franklin, 505 S. Fillmore Ave., Kirkwood 22, Mo.

SELL OR TRADE — 1475-1100-0-1100-1475, 300 ma. Kenyon plate trans. Want 750-600-0-600-750 250 ma. plate trans., tuning cond., or what have you? John M. Hicks, 1136 Margray St., Pittsburgh 7, Pa.

SELL OR SWAP — Disc recorder mech. in case and 40 discs, $9; intercom cabinets with switches and speaker, $1 each; recording wire, $15; hour bulk spool, $8; port. radio, $3. Want large amount recording tape. R. Lackner, 2029 Bradley, Chicago, Ill.

FOR SALE — Gonset commander with mobile VFO, $110, good cond.; Abbott TR-4A 2-meter xmitter-rcvr, clean, $12. James Calfain, 185 Lincoln St., Worcester, Mass.

SWAP — Custom radio for 1951 Ford. Want BC-221 or LM frequency meter or hi-fi speaker. L. Hetchler, 6101 N. 2nd St., Rockford, Ill.

WANTED — Modulator using 807's P.P. for 125 w. xmitter or modulation xformer for same. George Leininger, 16412 Marquis Ave., Cleveland 11, Ohio.

FOR SALE — Supreme Audolyzer, $20; K and E N-4053-3 slide rule, $6; Sams binders, $1.50 ea., all 8 for $10; Sams sets 1 thru 7 and Riders Vol. 14, $10 for all. You pay postage. Charles H. Schulz Jr., 5602 Belle Vista Ave., Baltimore 6, Md.

TRADE — AT-1 xmitter, A-1 cond., Bliley crystal and key, separate speech amp. and modulator with power supply, for like value. T. C. Fratia, Paxton, Ill.

WANTED — Two 25D8 tubes for Stewart-Warner radio. State price. Arthur Miller, 2325 N. 22nd St., Lafayette, Ind.

WANTED — V disc, World War II transcription records in good cond. Send list and price. Donald Ringler, 100 Irvington St., SW, Washington 24, D. C.

FOR SALE — GE model FA-21-A professional arm (made by Gray) with micro-groove weight, in exc. cond., paint only slightly chipped, $23 FOB. Hal Magargle, 3106 Sycamore Lane, Norristown, Pa.

WANTED — Elmac mobile rcvr. and power supply. Condition? Freedman, 144-34 72 Drive, Flushing 67, L. I., N. Y.

SELL — 30 klystrons type 707A in original, unopened cartons, $1.00 each. S. Consalvo, 4905 Roanne Drive, Washington 21, D. C.

WANTED — Instructograph code machine with tapes. Cash or trade for radio parts, usable TV pix tubes. J. L. Anderson, 621 9th St., Ames, Iowa.

FOR SALE — Altec 602-A 15" Hi-Fi speaker, $60; Altec 603-B, $30. Both l. n. Alan Torgerson, 1418-19th St., Des Moines, Iowa.

WANTED — FM xmitter, BC-604 (20 - 27.9 mc.) or FM xmitter covering approx. same frequencies. Jim Campbell, 413 N. 4th Ave. E, Duluth 5, Minn.

WANTED — National 173 table model loud speaker. Philip Krayniak, 3636 Willett Ave., Bronx 67, N. Y.

FOR SALE — Mobile set-up: Sonar MR-3 with power supply, $45; 30 w. 807 clamp xmitter 20 m. with dyn. supply, $45; Master antenna and 20 m. load coil, $10 — all for $80. Stan Egelberg, 3630 Barnes Ave., Bronx 67, N. Y.

WANTED — Radio and TV schematics. State price and sets covered. H. C. Aycocks, Box 704, Badin, N. C.

FOR SALE — Complete shop of Precision test equipment, tubes, parts, manuals; Also rifles, shotguns, Navy 7 x 50 binoculars. No reasonable offer refused. Radio Service, 1225 N. Lindsay St., Kokomo, Ind.

FOR SALE — One model 625C mine detector in l. n. cond. J. Leo Buchmann, c/o Police Department, Kenosha, Wis.

SELL OR SWAP — Two ICA 3866 metal racks (67¾ x 22 x 18) and BC-696-A xmitter for test equip. Alex Schnipper, 79 W. 45th St., Bayonne, N. J.

WANTED — Test equip., kit types preferred, VTVM; sig. gen., condenser checker, high resistant VOM, in trade for Dick mimeograph, model 77A85, automatic feed, agency shop rebuilt. Preston A. Taylor, Box 55, Elnora, Ind.

FOR SALE — CREI Sections 1 and 2 Advanced Practical Radio Engineering courses complete with all examinations and answers. Make offer. P. B. Collins, 6 Histella St., Santurce, Puerto Rico.

FOR SALE — Like new GE ST-2A scope, $150; Hickok model 288X sig. gen., $150; Rider's Tekfiles, 1 through 56 and others, $25; test bench costing $175, $50. All plus shipping charges. George Miller, 251 Bonita Ave., Pasadena 10, Calif.

FOR SALE — Three 0-1 ma. meters, 4 in. square bakelite case, knife-edge pointer, VOM scale, 50 ohm internal resistance. In original boxes, $5 each postpaid. L. Cohen, 151-09-34th Ave., Flushing 54, N. Y.

FOR SALE — Philco TV FM visual alignment gen. model 7008. Complete scope, sweep genrator, marker in one package, cables included. Cost $465. Make offer. Tire Trading, 239 Halsey St., Newark, N. J.

SELL OR TRADE — 46 QST's 12-48 to 3-55, 16 CQ's 2-53 to 12-54; Proceedings IRE 2-49 to 6-51; IRE Directory 1950; Principle of TV Engineering, Fink. Marvin Tepper, 81 Wolcott St., Malden 48, Mass.

WANTED — 1949 and up auto radios, custom built, will pay top dollar if A-1. Also want short-wave sets to receive 25 to 100 mc. Best Radio TV, 3349 Fulton Rd., Cleveland 9, Ohio.

WANTED — Pointer coupons from Olson Radio Warehouse, Akron, Ohio. Cash or trade electronic or ham gear, test equip., 16 mm movie films, etc. I need many coupons. R. N. Eubank, 1227 Windsor Ave., Richmond 27, Va.

FOR SALE — Books: Principles of TV Engineering, Fink; TV Simplified, 2nd edition, Kiver; Radio Servicing, Theory and Practice, Marcus; Mathematics for Electricians and Radiomen, Cooke. L. A. Spriggs, 155 Wellington Ave., Washington, Pa.

FOR SALE — Battery eliminators 6 v. Heathkit model B-C1, $15, NRI volt-ohm-miliammeter, model 44 (10,000 ohms DC — 2,000 ohms AC), $18 FOB. 10-day money-back guarantee. R. C. Hequet, 795 N. 10th St., Kanakee, Ill.

FOR SALE — NRI 34 sig. tracer, $35; Superior Instruments Co. tube tester model TV-11, $25; NRI VOM model 45, $20; Eico 322 sig. gen., $15; NRI diagram manual, $5. Wood's Radio Service, Box 75, Jeffersonville, N. Y.

SELL OR SWAP — Hallicrafter S-40A, ARC-5 xmitter 3-4 mcs. modified, prop pitch motor, Ford 1941 radio, 7EP4 and 14CP4 tubes, 0-400 ma., 0-50 ma., 0-30 ma., 0-100 ma., and 0-200 ma., meters. R. Faeth, 11 Godfrey Terrace, Glen Rock, N. J.

WANTED — Tech. manual and 10-contact power plug for ART-13. Name your price for either or both. J. Wiliams, Box 366, Harrisburg, Ark.

WANTED — One 10BP4 picture tube, used in working cond. Cash or trade model airplane motors and fishing equip. E. A. Sawyer, P. O. Box 346, Marshall, N. C.

FOR SALE — Precision E-200 sig. gen., Anchor booster ARC 100-75, Eico VTVM 221, Heathkit battery eliminator, meter broken, output OK, Sams Photofacts. Francis Crape, 217 Phillips Ave., New Bedford, Mass.

FOR SALE — American Educator Encyclopedia, $79.50; I.C.S. General Radio Texts, $28; both never used. Want Precise VTVM 9071M or RME DB22A or Granco UHF converter model DUC in A-1 condition. Earl R. Rogers, Box 148, Rayland, Ohio.

SWAP — 12½" Motorola TV plus cabinet and spare pix tube; good cond., for 152-174 Mc. FM rcvr., or bench saw. R. Toldrian, 392 Golf Ave., Maywood, N. J.

SWAP OR SELL — Unused commercially built mobile xmitter 50 w., 10 meter, for test gear or ham equip. Also BC-1068A, 14 tube 2 meter rcvr. and ARC-5 2-meter transmitter. Bob Siegel, 130-18 223rd St., Laurelton 13, N. Y.

FOR SALE — Complete 120 w. Fone and CW Station, VFO built in-with HQ129X rcvr. and speaker. N. Y. C. area only. H. Paskin, 1614 East 12th St., Brooklyn, N. Y.

WANTED — Tape recorder, good cond., must have 15 inches per second speed and be twin-track. Also timer. Edward Lind, 686 Georgia Ave., Brooklyn 7, N. Y.

WANTED — Sweep generator; Heathkit or other using reactance tube sweep. S. A. Campbell, 1073 Mohawk Rd., Schenectady 9, N. Y.

BUY OR TRADE — Electronic photo-flash unit, need not be in working condition for Gromme's 50PG-2 Hi-Fi amplifier, in exc. cond. M. Bierman, 118-14 83rd Avenue, Kew Gardens, N. Y.

FOR SALE — Collins 32V3, exc. cond., $500. No trades. Set of B & W 150 w. swinging link BVL type coils for 80, 40, 20, & 10 meters. Don DeShazo, Jr., 529 Blackstone Ave., LaGrange, Ill.

WANT — Disc recorder less amp. playback and cutting head. Swap for Television set, scope. Emory Corron, 4096 Redonda Lane, Dayton 6, Ohio.

SWAP — GE exposure meter type DW-68, for Weston 813 sensitrol meter and Weston 712 relay. Mitchel Katz, 147-11 76th Ave., Flushing 67, N. Y.

TRADE — Surplus rolls of film Ansco SSS 9½ x 390, Eastman Super XX 9½ x 200 sealed cans for 3" TV set, KW RF final, Gonset tri-band converter, aerial camera, lenses, or make offer. Jim Wright, 2319 East Indianola, Phoenix, Ariz.

WANTED — Tubes, types 2A3 and 6W7G, any quantity. Cash or trade test equip. Harold Goff, 918 William St., Bridgeport 8, Conn.

WANTED — Hallicrafter S-29 portable, RCA TV calibrator for Devry sound projector, Meissner analyst, or cash, Okey Gill, Coal Fork, W. Va.

SELL OR TRADE — Sams Photofacts 250 thru 271, l. n., $33; Cathode Beamer Kinescope analyzer, $225. Need NRI model 56 scope. Nelson's TV Sales and Service, Mahnomen, Minn.

WANTED — SCR-522 rcvr. and xmitter with power supply. Harvey-Wells TBS-50, also Gonset Tri-band converter. J. F. Trautvetter, 29 Richelieu Ter., Newark 6, N. J.

WANT — Good clean comm. rcvr. and tape recorder. Trade S-72; E200C; Precision 250 sig. tracer, all in good cond.; CREI, DeForest, and NRI, complete courses (last two with kits). J. H. Goode, 1817 West Octave, Pasco, Wash.

WANTED — Radio and TV test equip., send make type, cond. and price asked. I. E. Frost, 643 Crescent Ave., Rumford, Me.

FOR SALE — Books: Video Handbook-Scheraga and Roche, and Radio-Electronics Handbook, Roche and Boyce, $3.50 each. C. Wendell, 19 Donald St., Bloomfield, N. J.

SWAP — Tubes, motors, meters, TV booster xformers, relays, solonoids, tenna rotors and guns, for musical instruments or? Thomas Rohland, RR 3, Martinsville, Ind.

SWAP — National SW-3 rcvr. with schematic, 5 sets of coils, 20-40-80, are band spread, exc. cond. Want 2 or 3-way intercom, or make offer. William O. Lemodi, 409 Benefit St., Providence 3, R. I.

WANT — BFO control for a BC-348-Q rcvr., also the BC-348-Q manual, AN-08-10-112 long wave rcvr., from 15 kc. to at least 600 kc. Charles W. Leigh, 162 Passaic St., Trenton 8, N. J.

FOR SALE — Hickok 156A traceometer, guaranteed, $75; Clough-Brengle 127 scope and frequency modulator, $50. Paul Capito, 637 W. 21st St., Erie, Pa.

FOR SALE — Resistors, condensers, 600 or more tubes, test equip., Riders manuals 1 through 14, Radio Photofact Service 10 books over $1800 net price, lot for $1,000. Scotts Radio Service, 20 Cherry St., Oneonta, N. Y.

FOR SALE — Approved A-400 sweep sig. gen. and A-470 linearity pattern gen., $30 each and A-465 field strength meter, $45; Echophone EC-1A communication rcvr., $18. Chas. W. McDonald, 4492 Gratiot Ave., Port Huron, Mich.

FOR SALE — Eico 221K VTVM wired, never used, $30. Dick James, 1214 Fairoaks, Peoria, Ill.

FOR SALE — HT-9 xmitter complete; SX-25 rcvr.; Telrad 18A frequency standard; Tayburn 10" TV slave. All l. n. cond. Samuel Ferraro, 5025 54th Pl., Hyattsville, Md.

SELL — Dumont 27A scope, $60, Precise VTVM 7½" meter high voltage probe to 30,000 v., $30. Both in exc. cond. Henry Coakley, 4 Ivaloo St., Somerville 43, Mass.

WANTED — 12 v. VHF aircraft transceiver or old style Narco VHF xmitter, rcvr., with Omnirange. Herman's Radio Service, 803 W. Locust St., Bloomington, Ill.

SELL OR TRADE — Books, magazines, test sets, parts, ham equip., radios, turntable, amplifiers, TV sets. Charles E. Spitz, 1420 South Randolph St., Arlington 4, Va.

WANTED — Complete 17" and 21" TV chassis, ready for cabinets on approval only. F. Ramirez and Sons, 144 Liberty St., Mayaguez, Puerto Rico.

FOR SALE — Complete set of 95 lessons home study course in Radio and Television by Sprayberry Academy of Radio, $20. Gerry Pelrin, 86 Peach St., So. Braintree 85, Mass.

FOR SALE — IRE Proceedings, 1945 thru 1953 (no ad pages); Radio Engineering, 3rd edition, Terman; Television Engineering, 2nd edition, Fink. M. Nichols, 367 East 55th St., Brooklyn 3, N. Y.

FOR SALE — 3 dynamotors, 12 v. 12 a. input; 500 v., 250 ma. output with filter base, perfect cond., $15 each; also Bendix TA-12C aircraft xmitter with modulator and dynamotor. Best offer. V. K. Overman, Duke Inn., Elizabeth City, N. C.

SELL OR TRADE — Motorola FM TU-30D 30 w. mobile xmitter, complete with dynamotor and tubes, ready for operation. Best offer or what have you to trade? Ralph Villers, Box 1, Steubenville, Ohio.

FOR SALE — Heathkit G5 sig. gen., l. n., $12; pair telephones and ringer boxes, $15; 2 trade-in 10" TV sets, $20 each; 80 TV, radio, photography and mechanical magazines, $10 FOB. Ace TV, 5341 Cordelia Ave., Baltimore 15, Md.

SELL — Sams Photofacts, in binders, vols. 1 through 18, l. n.; Stancor Clipper-Filter SA-403-A, $4.50; JK-3910 kc. x-tal, $2; unused old-type receiving tubes, cheap. Calvin J. Evans, LaGrange, Ind.

FOR SALE — Concertone 1502-D in exc. cond., Hysteresis synchronous drive motor, dual track heads, NAB hub adapters 2 reels, of tape, $280. Norman W. Tetenman, 2350 East 27th St., Brooklyn 29, N. Y.

FOR SALE — Teleplex code trainer, exc. cond. 10 tapes, key, phones, instructions, $15; DeForest 1947 Radio-TV course, lessons only, $8. Both FOB or trade for test equip., etc., Frank Damico, 86-75 Midland Pky., Jamaica 32, N. Y.

FOR SALE — Narco VTLR-2 12 v. aircraft transceiver VHF xmitter with 2 xtals, low freguency and broadcast rcvr., $150. David Barlin, 257 Red Maple Dr. So., Levittown, L I., N. Y.

SWAP — Radio and TV tubes, electronic equip. for high speed code records. Donald Jonas, 9113 Grant Ave., Brookfield, Ill.

FOR SALE — BC-221C frequency meter with original calibration book, AC regulated power supply, set of spare tubes, $80. Rudolph A. Lazzazero, 245 Kingsley St., Buffalo 8, N. Y.

FOR SALE — APN-9 Loran in original carton, $285; PE-206 inverter, $10. Both l. n. BC-221 and with original calibration book and AC supply in very good cond., $85 FOB. R. L. Shahan, R. 1, Burton, Wash.

WANTED — RCA-Victor model 87 K chassis, band-switch and parts in good condition, must be reasonable. O. E. Williams, 36 Belmont St., Hartford 6, Conn.

FOR SALE — Lab. comparison rear load corner speaker cabinets with 5" tweeter and 12" edge treated woofer RCA or GE $19.95, Permoflex, $24.95, or 4 spec. Sentinel 12" ringed cone woofers, $19.95. J. C Davis, 9014 N. Laramie Ave., Skokie, Ill.

FOR SALE — Monitoradio FMC-1L6 30 to 50 mcs. rcvr., $100 FOB. W. H. Weiss, 1009 E. Riverside Ave., Merrill, Wis.

WANTED — Old radios, books, magazines, wireless xmitters and rcvrs., parts and catalogs. Pay cash and shipping charges. State exact cond. and price. Robert G. Middleton, 915 South Broadway, Park Ridge, Ill.

FOR SALE — Precise 308 scope, $150; T.I.C. 1210 RF Wobbulator with color crystal, $300; Measurements Corp. FM sig. gen. model 78, $75; Kay Megesweep, $85. Vincent Iavarone, 1218 Leland Ave., Bronx 72, N. Y. C.

SELL OR TRADE — TV and hard-to-get radio tubes for other types. Unused Rauland 17LP4 Pix tube, $20. Andrews, 740 Maple St., Bethlehem, Pa.

FOR SALE — Webster-Chicago model 80 wire recorder. Without top cover and mike. Needs slight repair, $35. H. Ursillo, 694 North Broadway, East Providence, R. I.

TRADE — Riders manuals vols. 1-7 and 11. Want model T Ford parts. John F. Prajko, 2235 Longshore Ave., Philadelphia 49, Pa.

WANTED — All kinds of TV and radio test equip. Give cond., age, and price. J. Blanton Box 158, Dahlgren, Va.

WANTED — All types of FM rcvrs. covering 30 to 50 mcs. and/or 150 to 170 mcs. R. L. Evans, Jr., Box 28, Ambler, Pa.

FOR SALE — Riders manuals 1 to 5 abridged, and 6 through 18 complete with all indexes, l. n. Best cash offer. Murphy Radio, 321 State St., Carthage, N. Y.

WANTED — Dial plate for Midwest Radio, 1937-11 tube. Cash or trade. Porter Electric and Radio Shop, 487 East Main St., Chillicothe, Ohio.

SELL OR TRADE — Complete TV course with four built kits Red's Radio and TV Service, Box 12, Union Furnace, Ohio.

WANTED — 2.5 KVA or larger 110 v. 60 cycle alternator, with or without prime mover. Cash or will trade top ham gear. C. T. Francis, Nashua Rd., North Billerica, Mass.

FOR SALE — Riders TV Vol. 1 and 2, $20 for both; radio rcvr. BC-454B 3-6 mc., $10; Eico 5" scope, $35. H. Gathercole, 45 Aberdeen Dr., Huntington, L. I., N. Y.

FOR SALE — Sam's TV Tube Location Guide books TGL-2 and TGL-3, $1 each. Also QST's, 10c each. John Zilinsky, 629 East Sixth St., South Boston 27, Mass.

FOR SALE — Jackson CRO-2 scope, Jackson TVG-2 generator, scope demodulation probe, all like new, for $300. F. C. Barney, Weir, Kan.

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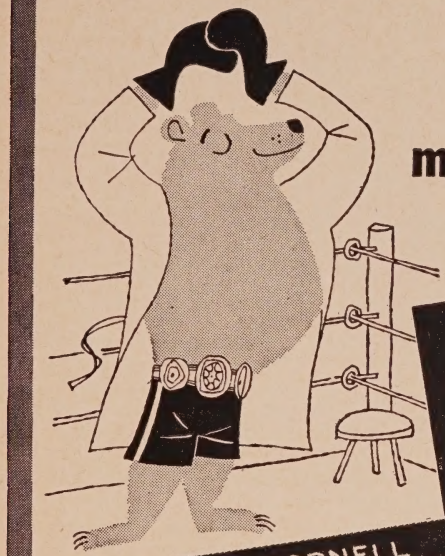

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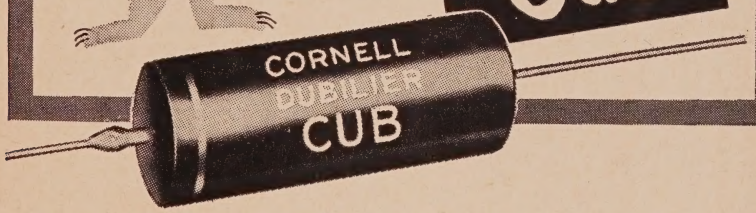

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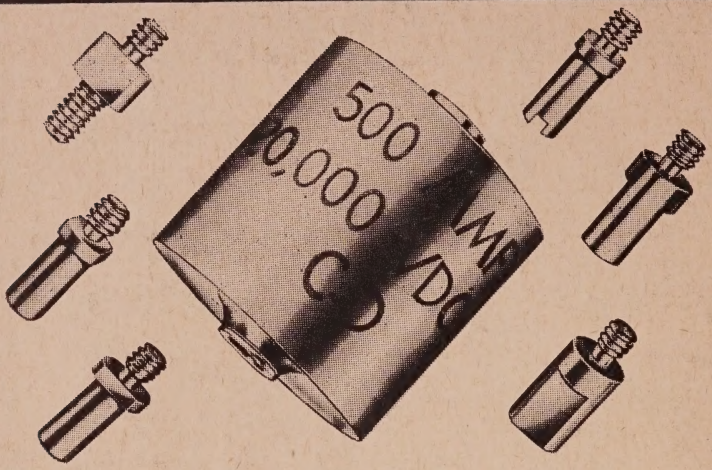

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